generation by government corporation.

The paper will outline a scenario for accelerated development of geothermal energy resulting in less dependence on fossil fuels.

PARCHMAN, W. L., JR., and JOHN W. KNOX, Sunoco Energy Development Co., Dallas, Texas

Exploration for Geothermal Resources in Dixie Valley, Nevada—A Case History

After several years of reconnaissance geology in Nevada, an exploration program to evaluate the geothermal resource potential of Dixie Valley was begun in 1974.

Between 1974 and 1978, Sunoco Energy Development Co. conducted two heat flow drilling programs, a resistivity survey, a seismic emission study, a ground noise survey, two magnetotelluric surveys, a hydrology study, and a surface geology survey.

The synthesis of the data resulting from these projects into the regional geologic framework led to the acquisition of geothermal resource leases from fee property owners, through open file application of federal lands, and by participation in the federal KGRA competitive lease sale of May 1976.

On September 15, 1978, Sunedco began drilling the S.W. Lamb 1 which became the discovery well. Development drilling continues.

PARIS, J. P., and A. COLLEAU, Bur. Recherches Geologiques et Minieres, Noumea, New Caledonia, and M. ESTERLE, S.L.N., Noumea, New Caledonia

Preliminary Metallogenic Map of New Caledonia: First Part—Mineral Deposits Associated with Overthrusted Ophiolite

The economic development of New Caledonia is almost entirely dependent upon the exploitation of ore bodies emplaced within an overthrust ophiolite complex which covers about one-third of the island. The overthrust was an Eocene event and the ores are associated with its ultramafic rocks, including peridotites which have been exposed and weathering since that time. One of the world's three largest nickle deposits (with accessory cobalt) occurs in the weathering peridotite and the ultramafics have yielded 3.5 million tons of chromite.

A research project financed by the Delegation for Scientific Research of the French Ministry of Industry (DGRST) has provided an understanding of the geology of the ophiolite complex and the phenomena conducive to chromite mineralization. Economic and geologic data are being synthesized to produce a metallogenic map of the island. This will be a contribution to the metallogenic map of the ophiolite belt of the world (part of the IGPC project: ophiolites).

PARKER, JOHN M., Consultant, Englewood, Colorado

Finding the Undiscovered Petroleum of the Circum-Pacific

(No abstract)

PARTEL, WILLIAM S., Ministry of Energy, New Zealand

Coal in New Zealand Energy Scene

(No abstract)

PECK, DALLAS, U.S. Geol. Survey, Reston, Virginia

The Role of the United States Geological Survey in Pacific Basin

(No abstract)

PHILIPPI, BRUNO, Comision Nacional de Energia, Santiago, Chile

Chilean Energy and Mineral Resources for the 80s

This presentation gives an account of the general approach adopted by the Chilean government for the utilization of the country's natural resources. This approach stresses the role of the private sector in the exploration, exploitation, and commercialization of the resources, within the framework of a free and competitive market. In a small country like Chile with an open economy, the economic development of resources, such as energy and minerals, should be based on foreign investment and free access to the external financial market.

PIGOTT, JOHN D., and NANCY I. TRUMBLY, Univ. Oklahoma, Norman, Oklahoma

Northern New Guinea Wrench Fault System: A Manifestation of Late Cenozoic Interactions Between Australian and Pacific Plates

Cenozoic plate interactions between the Australian and Pacific plates have yielded a variety of convergent tectonic styles. Two major products of this convergence are the Sorong fault zone of Irian Jaya and the Ramu-Markham fault zone of Papua.

The Sorong fault system has been documented to extend westward more than 500 mi (800 km) from Teluk Sarera to Kep Banggai as a left-lateral strike-slip fault. The Ramu-Markham fault system is of disputed displacement and has been previously interpreted to extend from over 310 mi (500 km) just east of the Sepik River into the Huon Gulf.

A consideration of Australian-Pacific Cenozoic plate kinematics, Holocene vectors, earthquake focal mechanisms, photogeologic lineation analyses, and the assimilation of other pertinent geologic data suggests that the Ramu-Markham fault zone is an extension of the Sorong fault system and that together they represent significant left-lateral strike-slip motion in rigid crustal basement. This motion has produced large scale en echelon surface expressed faults and folds in detached overlying Neogene sediments. Furthermore, this wrench fault system has led to the transcompressional development and deformation of the Meervlakt, Piore, Sepik, and Ramu basins of northern New Guinea. An understanding of the tectonic evolution of these basins is tantamount to an assessment of their evolving hydrocarbon potential.

PIPER, D. Z., T. R. SWINT, and V. E. MCKELVEY, U.S. Geol. Survey, Menlo Park, California, and L. SULLIVAN, Lamont-Doherty Geol. Observatory, Palisades, New York

Distribution of Manganese Nodules in Pacific Ocean

The distribution of deep-ocean manganese nodules within the Pacific Ocean has been ascertained from bottom photographs and sediment cores. In the northeast quadrant of the Pacific Ocean, three areas exhibit a sea-floor coverage that commonly exceeds 50%. One area lies between the Clarion and Clipperton

fracture zones, a second is in the Central Pacific basin, and a third is in the vicinity of the Musician Seamounts. Correlation of hiatuses in sedimentation during the Neogene, with these areas of high nodule coverage, suggests that a low rate of sediment accumulation is of primary importance. Although the nodule distribution in the other three quadrants of the Pacific is less well documented, that of the central part of the South Pacific may be comparable in extent and consistently high coverage to those areas in the northeast Pacific. Bottom photographic stations, which show a high nodule coverage elsewhere in the South Pacific, are located in areas of active bottom currents.

The distribution of four, generally non-overlapping, groups of nodules has been examined in conjunction with the regional variation in nodule coverage. These four groups, distinguished by their composition, are those containing the following: (1) greater than 1.8% Ni + Cu, (2) between 1 and 1.8% Ni + Cu, (3) greater than 1% Co, and (4) greater than 35% Mn. No simple relation between the distribution of these groups and the degree of coverage is apparent. It is noteworthy, however, that nodules in the last two groups occur only in areas in which the nodule coverage is less than 10%. Nodules in the first two groups are found in all coverage categories, but those containing greater than 1.8% Ni + Cu have their highest frequency of occurrence in the area of high coverage between the Clarion and Clipperton fracture zones.

PLAYFORD, PHILLIP E., Geol. Survey Western Australia, Perth, Western Australia

Devonian Reef Prospects, Canning and Bonaparte Gulf Basins, Western Australia

Middle and Upper Devonian reefs outcrop spectacularly for some 220 mi (350 km) along the northern margin of the Canning basin, in a series of rugged limestone ranges. They extend into the subsurface of the basin, and may originally have continued for some 750 mi (1,200 km) in a belt girdling the Precambrian Kimberley block, to join with similar reefs known in the onshore Bonaparte Gulf basin. There is also evidence that they once extended into the Carnarvon basin, 930 mi (1,500 km) to the south.

The Canning basin reefs show similarities to the Devonian reefs of Canada, and for the past 25 years, they have been regarded as prime targets for oil exploration. However, the first potentially commercial discovery was not made in the basin until 1981, when oil was recovered from an Upper Devonian (Famennian) reef complex in the Blina 1 well. This well yielded flows of up to 905 bbl per day from the reefal carbonates.

Recent encouragement of oil exploration in Devonian reefs has also been obtained in the Bonaparte Gulf basin, in this case as a result of mineral-exploration activities. More than 20 drill holes, exploring for lead-zinc, encountered significant showings of oil and bitumen in Upper Devonian reefal carbonates and overlying Carboniferous carbonates, in a belt some 95 mi (150 km) long. They are probably the most extensive near-surface oil showings known in Australia. There appears to be a genetic relationship between secondary porosity development, base-metal deposition, and oil emplacement (in that order) in these carbonates.

There are strong grounds for optimism that further reef-associated oil discoveries will be made in the northern Canning basin, and the outlook is also promising for similar discoveries in the Bonaparte Gulf basin and the offshore area adjoining the Kimberley block.

PROSTKA, HAROLD J., Consulting Geologist, Estes Park, Colorado, and JAMES L. MOORE, and JOE LA FLEUR, California Energy Co., Inc., Santa Rosa, California

Geology and Geothermal Exploration, Southernmost Peru

The geothermal potential of a 1,350 mi^2 (3,500 km^2) area in the Andes of southernmost Peru was studied using Landsat imagery, aerial photos, and published maps and reports. In the study area, andesitic stratovolcanoes of Pliocene to Holocene age are situated on a 16,400 ft (5,000 m) high plateau underlain dominantly by Oligocene and Miocene silicic volcanic rocks and clastic sediments. The Tertiary section consists of >5,500 ft (>1,700 m) of permeable ignimbrites, lava flows, breccias, and tuffs capped by as much as 2,950 ft (900 m) of impermeable lacustrine sediments. Using satellite imagery and aerial photos, glaciated Pliocene and Pleistocene volcanoes were readily distinguished from those of Holocene age which probably are underlain by magmatic heat sources. Swarms of northwest-trending normal faults cut Quaternary volcanics and glacial deposits, and are coextensive with the belt of Holocene volcanism. Several elliptical structures 5 to 10 mi (8 to 32 km) across, defined by arcuate faults and chains of volcanic vents, may be traces of buried caldera sources for some of the older silicic volcanics. Surface hydrothermal features observed in the field (April 1980) include hot springs and geysers, fumaroles, altered areas, and extensive travertine and sinter deposits, many of them visible on Landsat imagery, but not shown on any published maps. The hydrothermal features occur near the main areas of Holocene volcanism and are localized along linear and arcuate fault zones and especially at intersections of faults. Sampling of thermal waters for geochemical thermometry and test drilling are planned for 1982, to assess the potential for geothermal power generation.

PUDJOWALUJO, H., Directorate of Mineral Resources, Republic of Indonesia, and D. BERING, Bundesanstalt fur Geowissenschaften und Rohstoffe, Federal Republic of Germany

Rock-Multielement-Geochemistry at Copper-Gold Anomaly in Kaputusan (Bacan Island), Moluccas, Indonesia

Geological reconnaissance and mineral prospecting on Bacan Island (Moluccas, Indonesia) by the Directorate of Mineral Resources of the Republic of Indonesia, from 1977 to 1979, resulted in the discovery of a copper-gold anomaly situated 7.5 mi (12 km) north of Kaputusan village. Technical cooperation with the Bundesanstalt fur Geowissenschaften and Rohstoffe of the Federal Republic of Germany, from 1980 to 1981, detailed the prospect with geochemical analyses and geologic mapping.

The interpretation of a geochemical pattern, based on analyses of 32 elements in 149 rock samples from test pits in the anomalous area, indicated porphyry copper mineralization. In the center of the anomaly, enrichment of Au, Mo, Bi, Zr, Rb, and K_2O was detected, with surrounding halos of Pb, Zn, Sr, MnO, Fe_2O_3 and trace elements. Ratios of Rb/Sr and K_2O/Na_2O provided further evidence.

SiO_2 and SO_3 are relatively rich in the southern part of the anomaly, confirming a previously mapped quartz sericite alteration, and secondary mica, in fractures and replacing mafic minerals, characterizes the northern, K_2O part. A rather high copper concentration (up to 1%) in weathered rocks of the northern part may record a relatively small pyrite concentration which served to prevent leaching by the acidic environment.